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(54) Title: EDIBLE FAT-CONTAINING PRODUCTS

(57) Abstract

A polyol fatty acid polyester or a mixture of polyol fatty acid polyesters comprising at least two different fatty acid residues and wherein the two most abundant fatty acid residues constitute at least 50 wt % of the fatty acid residues of the polyol fatty acid polyester, the most abundant fatty acid residue being selected from the group of: myristic acid, palmitic acid, stearic acid, arachidic acid, and the second most abundant fatty acid residue being selected from the group of: capric acid and lauric acid, and the weight ratio between the most abundant fatty acid residue to the second most abundant fatty acid residue is from 90 : 10 to 68 : 32.

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EDIBLE FAT-CONTAINING PRODUCTS

The present invention relates to edible fat-containing products comprising an indigestible fat-replacer.

In this specification, unless otherwise indicated, the term 'fat' refers to edible fatty substances in a general sense, including natural or synthesized fats and oils consisting essentially of triglycerides such as, for example, soybean oil, sunflower oil, palm oil, coconut oil, fish oil, lard and tallow, which may have been partially or completely hydrogenated or modified otherwise, as well as non-toxic fatty materials having properties similar to triglycerides, herein referred to as fat-replacers, which materials may be partially or fully indigestible. The terms fat and oil are used interchangeably.

Over the last decade many non-triglyceride fatty substances have been described as potential fat-replacers in food products. Examples thereof are waxes, e.g. jojoba oil and hydrogenated jojoba oil, polysiloxanes, acylated glycerides, polyalkoxyglycerolethers, dicarboxylic acid esters, polyol fatty acid polyesters and the epoxy extended derivatives thereof. Examples of disclosures of fatreplacers are e.g. DD 207 070, Journal of Food Science 49, 419-428 (1984), US 3,600,186, US 4,005,195, US 4,005,196, US 4,034,083, US 4,582,715, US 4,582,927, EP 0 233 856, EP 0 236 288, EP 0 235 836 and EP 0 254 547.

In particular polyol fatty acid polyesters, and more specifically the sugar fatty acid polyesters, such as e.g. the sucrose fatty acid polyesters, are receiving increased attention as low-calorie fat-replacers in edible products.

Substantially indigestible for human beings they have

physical and organoleptic properties very similar to triglyceride oils and fats conventionally used in edible products.

Polyol fatty acid polyesters are also reported to have use as pharmaceutical agents e.g. in view of their ability to take up fat-soluble substances, such as in particular cholesterol, in the gastrointestinal tract, and subsequently remove those substances from the human body.

Suitable polyol fatty acid polyesters are derived from aliphatic or aromatic polyols which comprise at least four free hydroxyl groups. Such polyols in particular include the group of sugar polyols, which comprises the sugars, i.e. the mono-, di- and polysaccharides, the corresponding sugar alcohols and the derivatives thereof having at least four free hydroxyl groups. Examples of sugar polyols include glucose, mannose, galactose, xylose, fructose, sorbose, tagatose, ribulose, xylulose, maltose, lactose, cellobiose, raffinose, sucrose, erythritol, mannitol, lactitol, sorbitol, xylitol and alpha-methylglucoside. A particularly preferred polyol is sucrose.

The term 'polyol fatty acid polyester' is intended to refer to any such polyesters or mixtures thereof which have a degree of conversion of 70 % or more, i.e. of which, on an average, 70 % or more of the polyol hydroxyl groups have been esterified with fatty acids. Preferred polyol fatty acid polyesters for use in the present invention have degrees of conversion of 85 % or more, or even 95 % or more.

A problem with conventional polyol fatty acid esters is that the mouthfeel, crystallisation and melting properties are often not optimal. This problem is especially apparent in polyol fatty acids which are intended to be used in confectionery products such as chocolate.

Confectionery chocolate products preferably are solid and crisp at ambient temperature, and at the same time fluid and soft at body temperature. For combining these two desired properties a steep melting profile between 20 °C and 35 °C, especially between 30 °C and 35 °C is important.

EP 350 981 (Unilever) describes polyol fatty acid polyesters for use in confectionary products, said polyesters having an N20 of 50-100 and an N37 of 0-5.

EP 271 951 (P&G) describes cocoa butter substitutes comprising sucrose fatty acid esters which are solid at ambient temperature and which have a lower solid fat content at body temperature.

US 4,810,516 (P&G) describes reduced calorie chocolate confection compositions comprising polyol fatty acid polyesters having a clear melting point of 30-36 °C and an SCI of at least 66 at a temperature of 6.6 °C below its clear melting point. This document also discloses a sugar fatty acid polyester wherein the fatty acid groups are myristate and laurate in a mole ratio of about 5 : 3, said material having a clear melting point of about 34 °C and an SCI at 27 °C of about 79.

EP 467 464 relates to fat compositions displaying Newtonian rheology.

EP 350 987 discloses fat compositions which do not rapidly solidify upon cooling down.

A problem with the polyol fatty acid polyesters of the above documents is that often they do not have the desired melting properties, i.e they are either too soft at lower temperatures and/or too hard at body temperature. Another problem with the polyol fatty acid polyesters as disclosed in these documents is that they often tend to undergo

further crystallisation after preparation, such that although the initial N35 is relatively low, this value increases in time providing an undesired waxiness and unsatisfactory mouthfeel to the product. Furthermore when these are used in the preparation of chocolates often difficulties are observed in demoulding and/or the products do not retain a glossy surface.

Melting properties of fatty substances can suitably be determined by measuring the N-line. The N-line is the graph of Nt-values versus the temperature t. The N_t-value is conveniently measured by the nuclear magnetic relaxation technique and is a direct measure of the level of solid fat content at temperature t. This method is suitably described in Fette, Seifen, Anstrichmittel 80(5), 180-186 (1978). To some extent the measurement of N_t-values is dependent on the temperature profile used to prepare the samples for the NMR measurement. For the purposes of the present invention the following preparatory temperature profile is adopted: 30 minutes at 60°C, 90 minutes at 0°C, 40 hours at 26°C, again 90 minutes at 0°C and finally 60 minutes at the temperature of the measurement, after which the NMR-measurement is carried out.

It is an object of the present invention to provide polyol fatty acid polyesters with a tailored melting behaviour and/or with a reduced tendency to post-crystallise upon storage.

Surprisingly it has been found that advantageous polyol fatty acid polyesters contain relatively high levels of two fatty acids in specific ratios.

Accordingly the present invention relates to a polyol fatty acid polyester, or a mixture of polyol fatty acid polyesters comprising at least two different fatty acid residues and wherein the two most abundant fatty acid residues constitute

at least 50 wt% of the fatty acid residues of the polyol fatty acid polyester, the most abundant fatty acid residue being selected from the group of:
myristic acid,
palmitic acid,
stearic acid, and
arachidic acid; and
the second most abundant fatty acid residue being selected from the group of: capric acid and
lauric acid;

and the weight ratio between the most abundant fatty acid residue to the second most abundant fatty acid residue is from 90: 10 to 68 : 32.

Also the invention relates to food products comprising from 1-100% by weight of these polyol fatty acid polyesters.

For the purpose of the present invention the most abundant fatty acid residue in the polyol fatty acid polyester(s) is the fatty acid residue which is present at the highest weight percentage based on the total weight of the fatty acid residues. The second most abundant fatty acid residue in the polyol fatty acid polyester is the fatty acid residue which is present at the one but highest weight percentage, based on the total weight of the fatty acid residues.

Polyol fatty acid esters of the invention may be prepared by any suitable method for the preparation thereof. Suitable methods are for example disclosed in EP 132,941, EP 132,293, US 3,963,699, EP 256,585, EP 301,634, EP 319,091 and EP 322,971. A particular preferred process is described in and involves the steps as disclosed in EP 256,585.

Preferably the octa-ester content of polyol fatty acid esters in accordance with the invention is more than 80%, more preferred more than 85%, most preferred more than 90%.

Preferably the polyol fatty acid ester is a surcrose fatty acid polyester.

Although applicants do by no means want to be bound by this theory, it is believed that the improved melting properties and/or crystallisation properites of polyol fatty acid polyesters are due to the specific division of fatty acid residues over the polyol fatty acid ester molecules. In particular it is believed that if the two most abundant fatty acid residues are present at a fairly high total level, while there is a specific ratio between the most abundant fatty acid residue and the second most abundant fatty acid residue, then the resulting polyol fatty acid polyesters have an intermediate degree of complexity, which results in an adequately short and relatively sharp melting profile and/or which does not give rise to an unacceptable degree of post-crystallisation. Furthermore it is believed that the specific choice of fatty acid residues as indicated above provides polyol fatty acid residues, which surprisingly have a melting behaviour which renders them especially suitable for use in food products, especially confectionery chocolate products.

Preferably the total level of the two most abundant fatty acid residues in the polyol fatty acid polyester is more than 60 wt% based on the total weight of the fatty acid residues, more preferred from 70 to 100 wt%, most preferred from 80 to 100%. Especially preferred are polyol fatty acid polyesters which are substantially free from fatty acid residues other than the two most abundant fatty acid residues.

The weight ratio of the most abundant fatty acid residue to the second most abundant fatty acid residue is from 90 : 10 to 68 : 32 more preferred 88 : 12 to 75 : 25, most preferred 86 : 14 to 80 : 20.

Preferably the most abundant fatty acid residue is selected from myristic acid and palmitic acid. Most preferably the most abundant fatty acid residue is myristic acid.

Preferably the second most abundant fatty acid residue is lauric acid.

A particularly preferred polyol fatty acid polyester in accordance to the invention contains myristic acid and lauric acid in a weight ratio of 90 : 10 to 68 : 32, the total level of myristic acid and lauric acid being more than 60 wt%, more preferred 70-100 wt%, most preferred 80-100 wt%, based on the total weight of the fatty acid residues.

Food compositions in accordance to the invention comprise polyol fatty acid polyesters as part or all of the fatty substances. Apart from polyol fatty acid polyesters as defined herein, food compositions of the invention may comprise digestible fatty substances such as triglyceride materials and non-glyceride fatty substances.

Accordingly to a second embodiment of the invention there is provided a food composition comprising from 1 -100 wt % of fatty substances, wherein from 50 - 100 % of the fatty substances are polyol fatty acid polyesters as defined here above.

The level of these fatty substances other than the polyol fatty acid polyesters may be up to 50 wt%, based on the total weight of the fatty substances, preferably, however the level is from 0-40 wt%, more preferred 0-30 wt%, most preferred food compositions of the invention are substantially free from fatty substances other than polyol fatty acid polyesters. For some applications it may however be advantageous to add from 0.5 - 35 % based on the total weight of softening oils or cocoa butter, e.g. digestible fats.

Depending on the type of food composition, the total level of fatty substances in the food composition of the invention may be from 1-100 wt%, for example 5-95 wt%. Some food compositions like shortenings, chocolate and dressings may comprise relatively high levels of fatty substances, for example 30-90 wt%. Other food compositions like sauces, soups, bakery products etc may comprise lower levels of fatty substances for example 1-30 wt%.

In any case, the fatty substances which are present in food compositions of the invention comprise a polyol fatty acid polyester material as defined hereabove, the level thereof preferably being from 60-100 wt%, more preferred 70-97 wt%, most preferred 80-95 wt% based on the total weight of fatty substances in the food product.

The optional conventional fat-component other than polyol fatty acid polyester may be triglyceride oils or fats of animal or vegetable origin. Suitable conventional triglyceride fats and oils include, optionally partially or fully hydrogenated, coconut oil, palmkernel oil, palm oil, marine oils, lard, tallow fat, butter fat, cocoa butter fat, soybean oil, safflower oil, cotton seed oil, rapeseed oil, corn oil sunflower oil and mixtures thereof. For use in chocolate confectionery products cocoa butter is a prefered digestible fat component.

The present invention is not specific to edible fat-containing compositions in any particular food area. It may be suitably be applied to food products such as spreads, margarines, creams, shortenings, bakery products such as doughs, cakes and biscuits, fried and snack products, fresh, hard and processed cheeses, meat emulsions, mayonnaise and dressings, confectionery products, such as desserts, fillings, chocolates, candies, chews, and icecreams.

Particularly preferred however is the use of the polyol fatty acid polyesters in accordance to the invention in chocolate confectionery products. Suitable chocolate confectionery products preferably comprise from 25-60% by weight of fatty substances, 0.001 to 60% by weight of sugar or other sweeteners such as for example aspartame, 5-35% by weight of cocoa powder or chocolate liquor and 0-40% of milk solids, 0-5% flavouring and/or colouring materials, 0-5% lecithin or other emulsifying agent, the balance being other suitable materials, e.g. carbohydrate or other bulking agents.

In another preferred embodiment of the invention the chocolate confectionery product of the invention comprises fatty substances having an N-value at 20 °C of at least 60, more preferred 70-100, most preferred 80-95 and an N-value at 35°C of less than 15, more preferred from 0-8, most preferred from 0-3°C. Preferably at least 50% by weight of these fatty substances are polyol fatty acid polyester materials according to the invention, more preferred 70-100%, most preferred 90-100%.

Preferably the above mentioned N-values can be observed, both directly after preparation and after storage for say 1 month at ambient temperature.

Chocolate confectionery products of the invention can be made by conventional techniques, such as for example described in US 4,810,516. Preferably the cooling regime applied to the chocolate is such that the product can be demoulded within 30 minutes after moulding.

The invention will be further illustrated by means of the following examples:

Example I

Sucrose fatty acid polyesters are obtained from various mixtures of myristic acid and lauric acid which are converted to the respective methyl esters and then reacted with sucrose in the presence of a potassium carbonate catalyst.

The N-values of the obtained sucrose polyesters were measured as described hereinabove at various temperatures. The following results were obtained:

weight ratio $C_{14}:C_{12}$	N20	N25	N30	N32.5	N35	N40
99 : 1	97.4	96.9	96.1	93.2	37.1	0.6
92 : 8	97.3	97.0	95.8	75.1	21.1	0.0
85 : 15	96.5	95.8	76.7	7.1	0.8	0.0

A plain chocolate is prepared from the above polyol fatty acid polyesters according to the following composition:

ingredient	wt %
polyol fatty acid polyester	32 %
sugar	49.6 %
cocoa powder	18 %
lecithin	0.4 %

The ingredients were mixed at 50°C followed by milling at 25°C using a triple roller mill, conched for 5 hours at 50°C in an end-runner, conch moulded, cooled at 10°C for 30 minutes, demoulded and stored at ambient temperature for 1 month.

The mouthfeel of the chocolate made from the 85 :15 mixture had an excellent mouthfeel and melting properties as compared to the other compositions. Furthermore the chocolate according to the invention did not show a substantial degree of post-hardenening when stored for 3 weeks at ambient temperature.

CLAIMS

1. A polyol fatty acid polyester or mixture of polyol fatty acid polyesters comprising at least two different fatty acid residues and wherein the two most abundant fatty acid residues constitute at least 50 wt% of the fatty acid residues of the polyol fatty acid polyester(s), the most abundant fatty acid residue being selected from the group of:

myristic acid
palmitic acid,
stearic acid, and
arachidic acid

and the second most abundant fatty acid residue being selected from the group of:

capric acid;
lauric acid,

and the weight ratio between the most abundant fatty acid residue to the second most abundant fatty acid residue being from 90 : 10 and 68 : 32.

2. A material according to claim 1, wherein the level of the two most abundant fatty acid residues is more than 60 wt %, more preferred preferred from 70 - 100 wt %, most preferred from 80 - 100 % of the fatty acid residues of the polyol fatty acid polyester(s).

3. A material according to claim 1 wherein the most abundant fatty acid residue is myristic acid and the second most abundant fatty acid residue is lauric acid.

4. Food composition comprising from 1-100 wt % of fatty substances, wherein from 50-100 wt % of the fatty substances are polyol fatty acid polyesters in accordance to claim 1.

5. Food composition according to claim 4 being a chocolate confectionery product.

6. Food compositions according to claim 5 wherein the fatty substances have a N-value at 20°C of at least 60 and an N-value at 35°C of less than 15.

7. Food product according to claim 5 comprising
   a) 25-60 wt% of fatty substances;
   b) 0.001-60 wt% of sugar or other sweeteners;
   c) 5-35 wt% of cocoa powder or chocolate liquor;
   d) 0-40 wt% of milk solids;
   e) 0-5 wt% of flavouring and/or colouring materials;
   f) 0-5 wt% of emulsifying agents.

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 93/00960

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A23D9/00; A23G1/00; A23G3/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A23D ; A23G ; A23L

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	EP,A,0 285 187 (THE PROCTER & GAMBLE COMPANY) 5 October 1988 see column 5, line 28 - line 55; claims 1,2,6-9 see column 8, line 9 - line 11 see column 2, paragraph 1	1-7

° Special categories of cited documents : [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
27 MAY 1993	11. 06. 93
International Searching Authority	**Signature of Authorized Officer**
EUR PEAN PATENT FFICE	KANBIER D.T.

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9300960
SA 72588

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0285187	05-10-88	US-A- 4810516	07-03-89
		AU-B- 600875	23-08-90
		AU-A- 1234688	01-09-88
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